

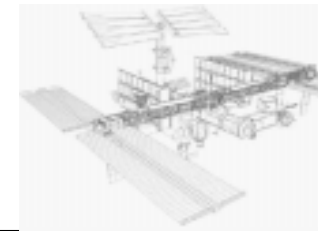
Can Small Payloads Fit on a Big Station?

Kathryn I. Clark, Ph.D.
Space Station Chief Scientist
NASA Headquarters
Washington, D.C.

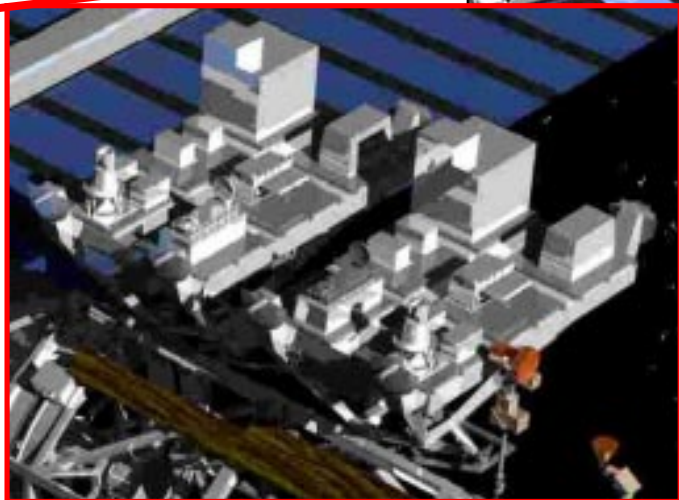
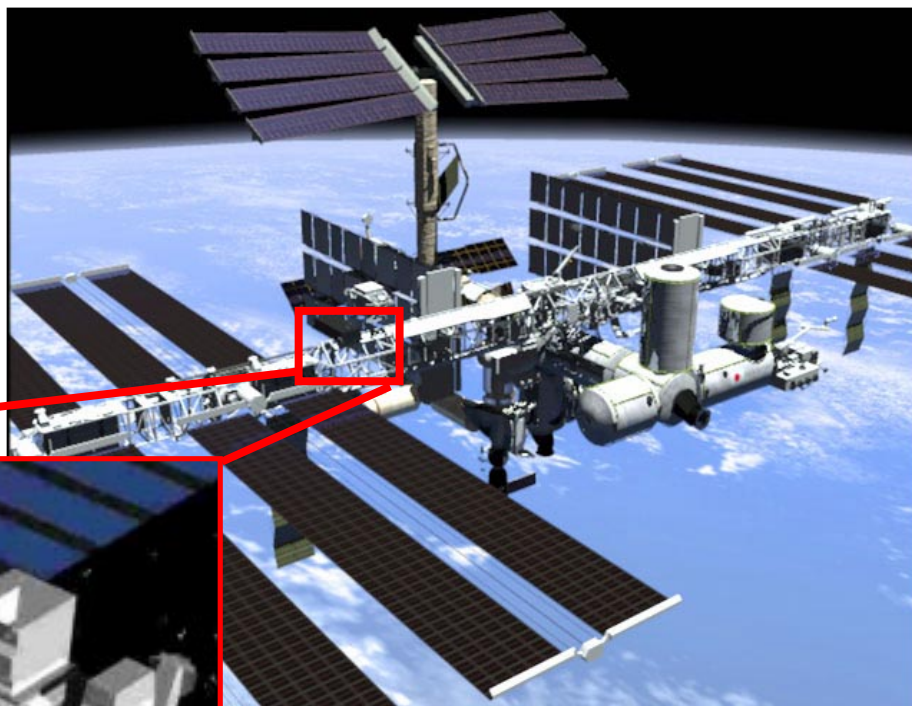
September 13, 1999



Standard External Payload Locations

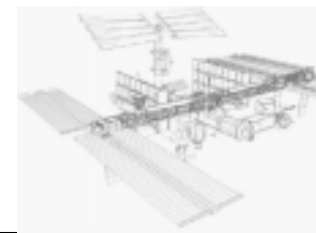


S3 Truss
Sites





Alpha Magnetic Spectrometer (AMS)



AMS as flown on STS-91



Scheduled for Flight on UF4

Sponsored by Department of Energy

Mission Objectives

- Search for anti-matter & dark matter
- Understand Cosmic Ray propagation.

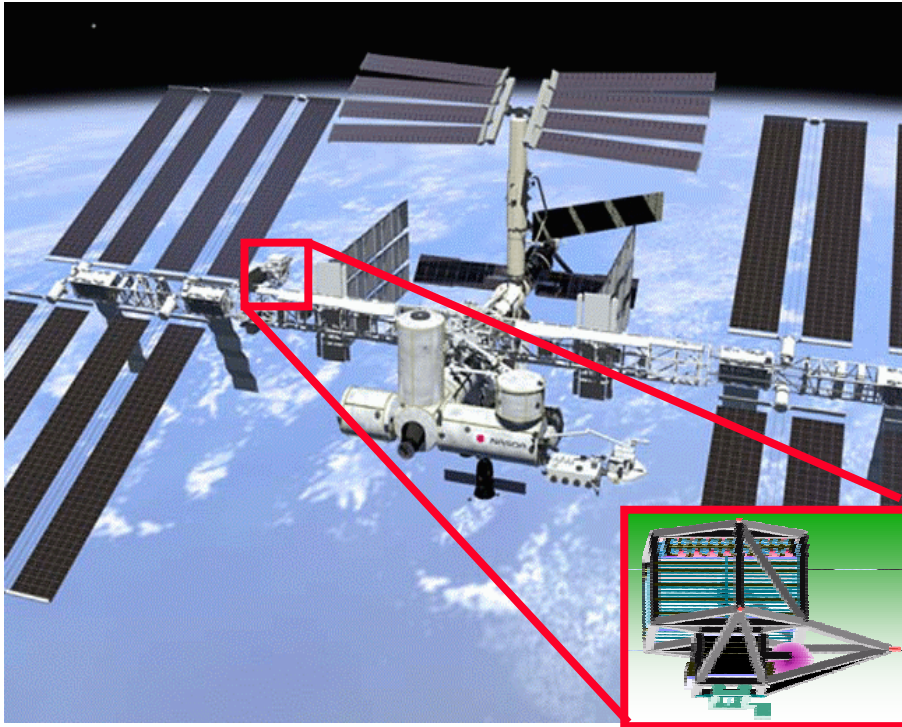
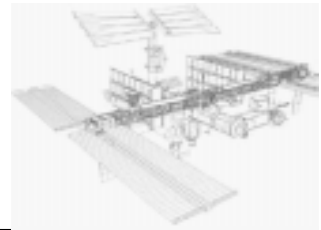
Instrumentation

- Strong magnet field generator
- Aerogel Cherenkov Counter
- Scintillators
- Silicon Trackers

43 Groups in 14 Countries



Advanced Cosmic-ray Composition Experiment for the Space Station (ACCESS)



Mission Objectives

- Spectral changes of cosmic rays at high energy
- Acceleration mechanism

Instruments

- Hadron Calorimeter
- Transition Radiation Detector (TRD)

21 Groups in 5 Countries are participating

Planned New Start

Follows the Alpha Magnetic Spectrometer



EXpedite the Processing of Experiments to the Space Station (EXPRESS**)**

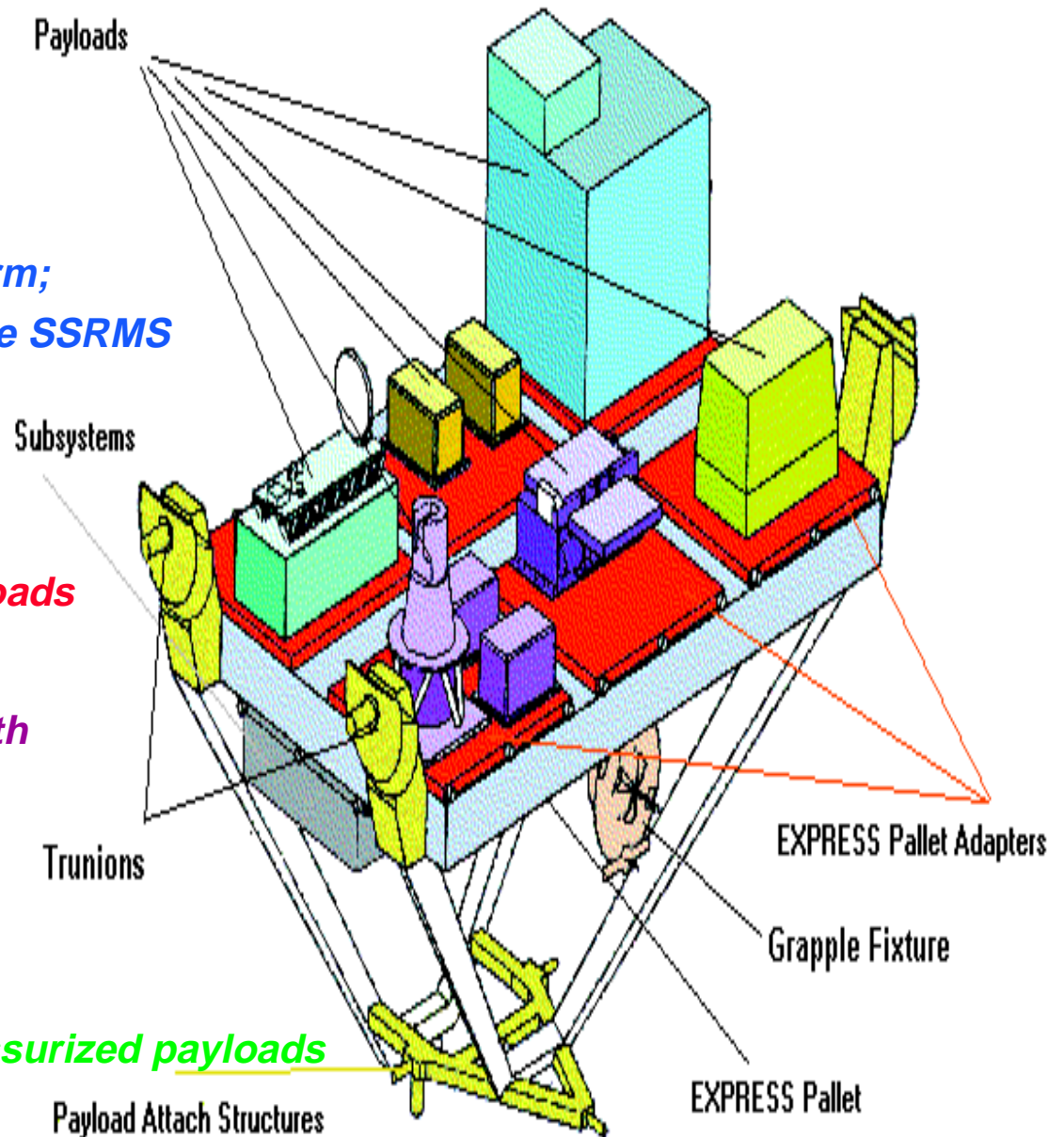


→ Quick response adaptive platform;
robotically serviceable with the SSRMS

→ Supports Code S, Code Y,
Commercial and
Engineering-Technology payloads

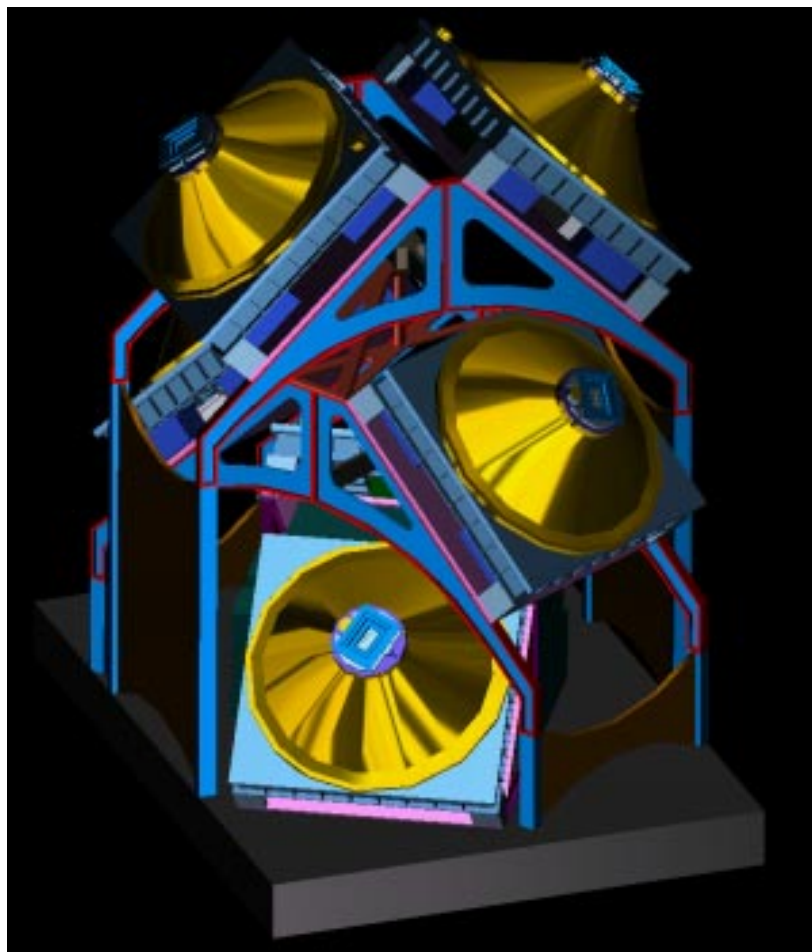
→ Provides capability to view Earth
and space from all directions

→ Attaches to Truss at four sites
accommodates up to 6 unpressurized payloads





Monitoring X-ray Experiment (MOXE)



Mission Objectives

- Detect fast X-ray transients
 - 10 milli-Crab transients to 0.6° in 24 hours
 - Monitor 300 sources > 2 milli-Crab
- Alarm for other X-ray missions

Instrument

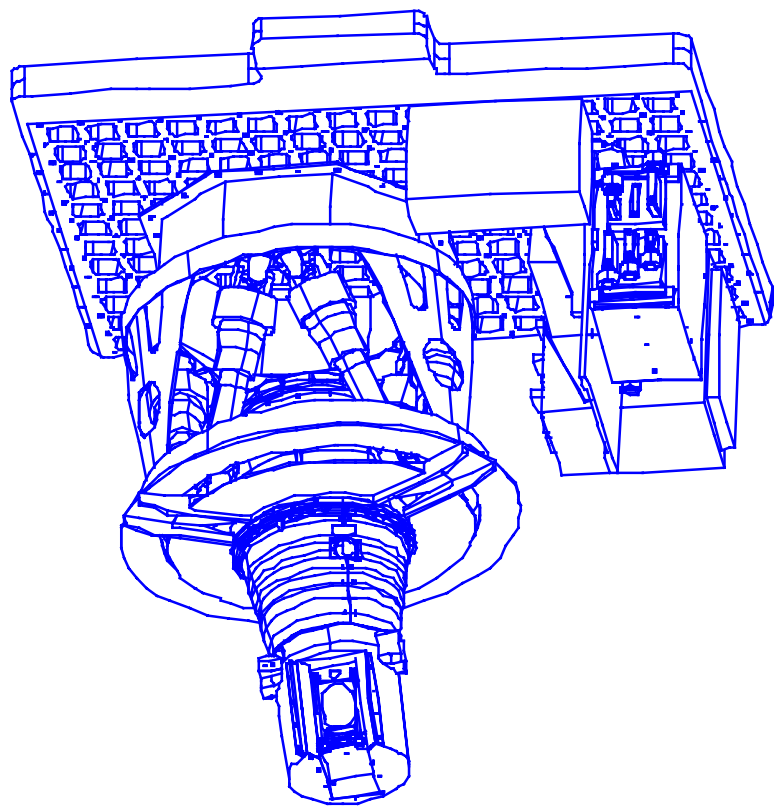
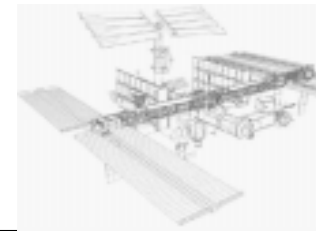
- Six X-ray pinhole cameras
- Bandpass of 2 to 25 keV

3 Institutes in 2 Countries

Potential Instrument / Not Manifested



Stratospheric Aerosol Gas Experiment (SAGE) III



Scheduled for Flight UF-3

Mission Objectives

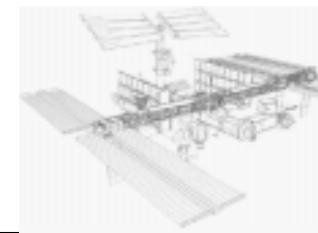
- Atmospheric composition, 0 - 150 km
- Spatial and temporal variability
- Effects of aerosols and clouds

Instrumentation

- f/4 Cassegrain telescope
- Spectrometer
 - Spectral range of 290 - 1550 nm
 - Spectral resolution of 1nm
 - Vertical resolution of 1-2 km



Silicon X-Ray Imager (SIXI)



Mission Objectives

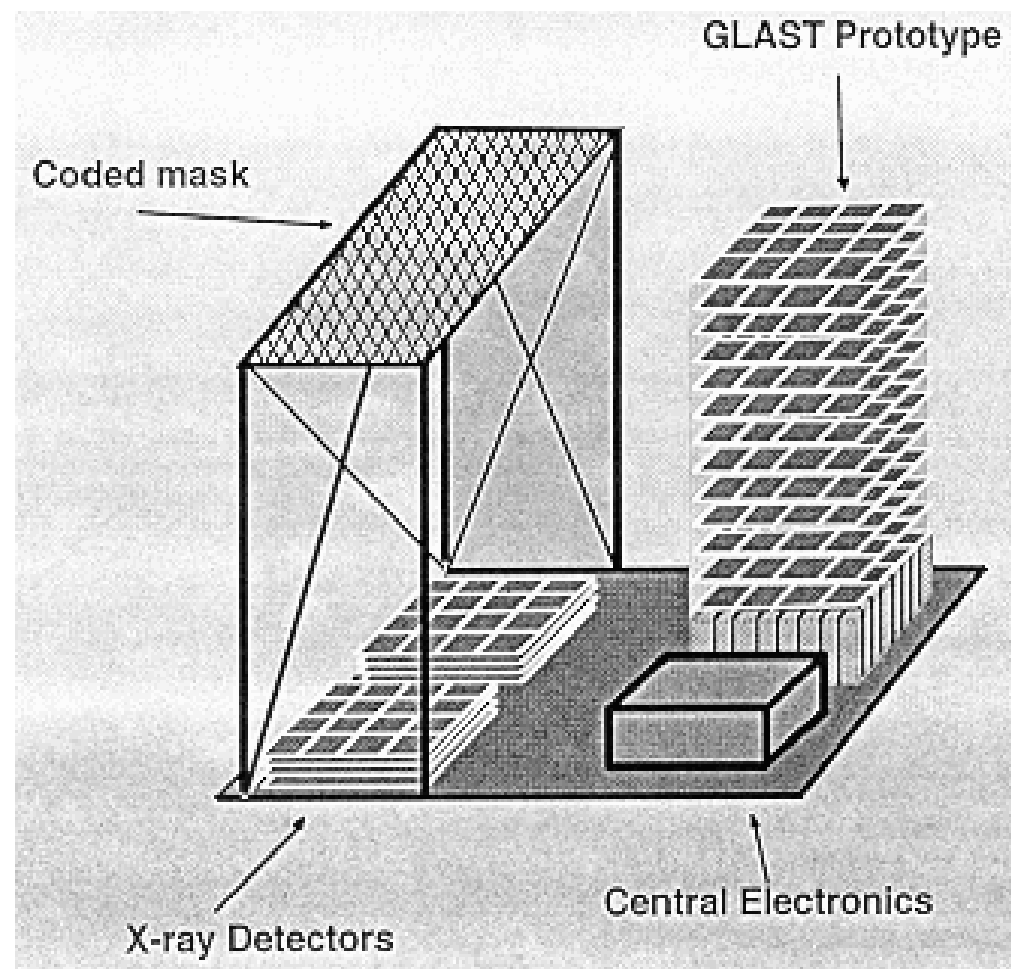
- Celestial and solar X-ray imaging
- Energies to 100 keV
- Follow-on to ARGOS/USA experiment

Instrumentation

- Coded-aperture mask, silicon strip detector stack X-ray imaging system
- GLAST prototype
 - Lead foil & silicon strip tracker units
 - Calorimeter - cesium iodide

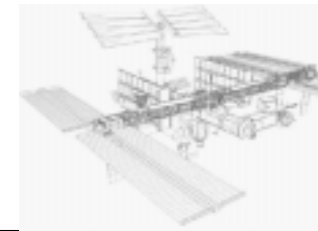
Not Manifested

Sponsored by Department of Defense





Spatial Heterodyne Imager for Mesospheric Radicals (SHIMMER)

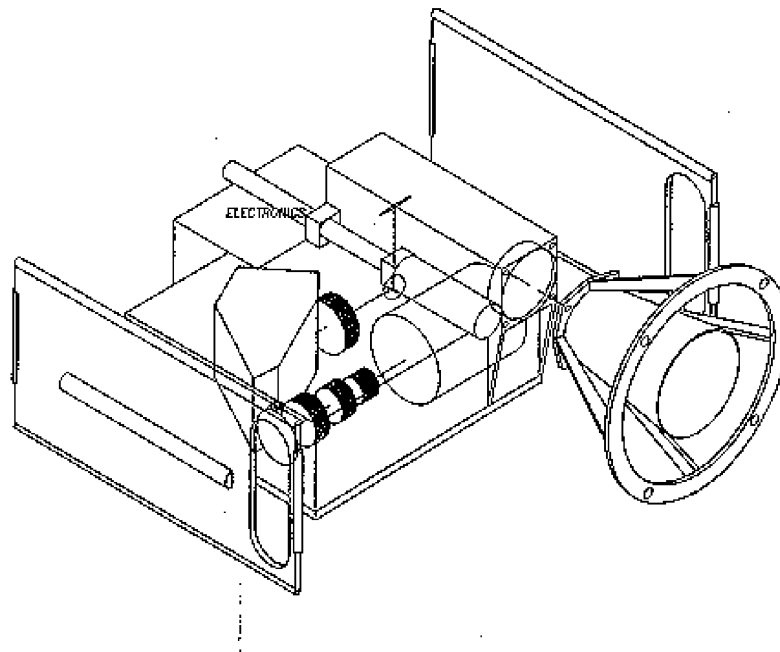


Mission Objectives

- Global maps
 - Hydroxyl (OH^\cdot)
 - Temperature and ozone density

Instrumentation

- Spatial Heterodyne Imager
 - Resolution of 0.0058 nm
 - Bandpass of 2.0 nm

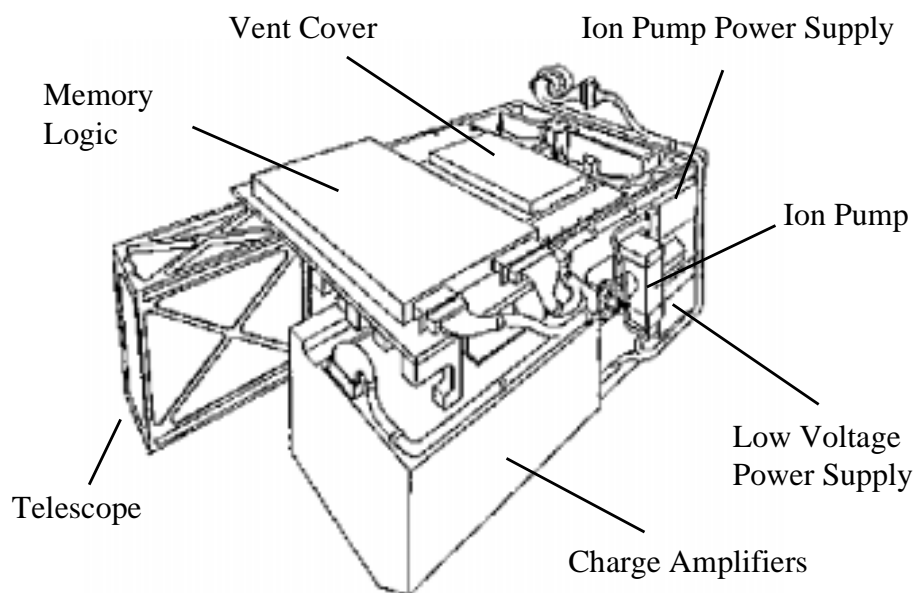


Scheduled for Flight UF-3
Co-manifested with TtANOS

Sponsored by Department of Defense



Thermospheric temperature & Nitric Oxide Spectrograph (TtANOS)



Mission Objectives

- NO, N, N₂, O
- Correlation with solar soft x-rays

Instrumentation

- Ebert-Fastie spectrometer
 - 250 Å passband ($\lambda > 1950$ Å)
 - 1 Å resolution
- Solar Photometer
 - Passband 20 - 100 Å

Scheduled for Flight UF-3
Co-manifested with SHIMMER

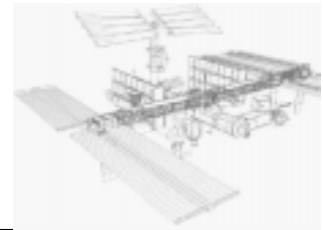
Sponsored by Department of Defense



"First"



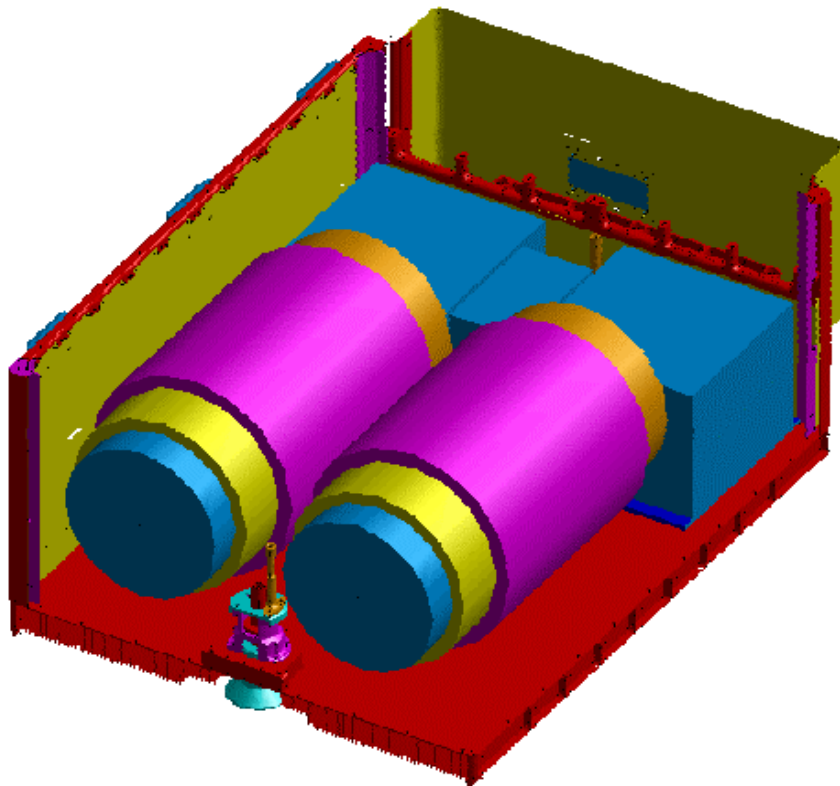
Attitude Control & Energy Storage Experiment (ACESE)



Scheduled for Flight 13A

Non-standard location - battery unit @ S4

Sponsored by ER&T



Mission Objectives

- 2.4 kW-hr of flywheel energy storage
- Battery replacement
- One degree of freedom attitude control torque.

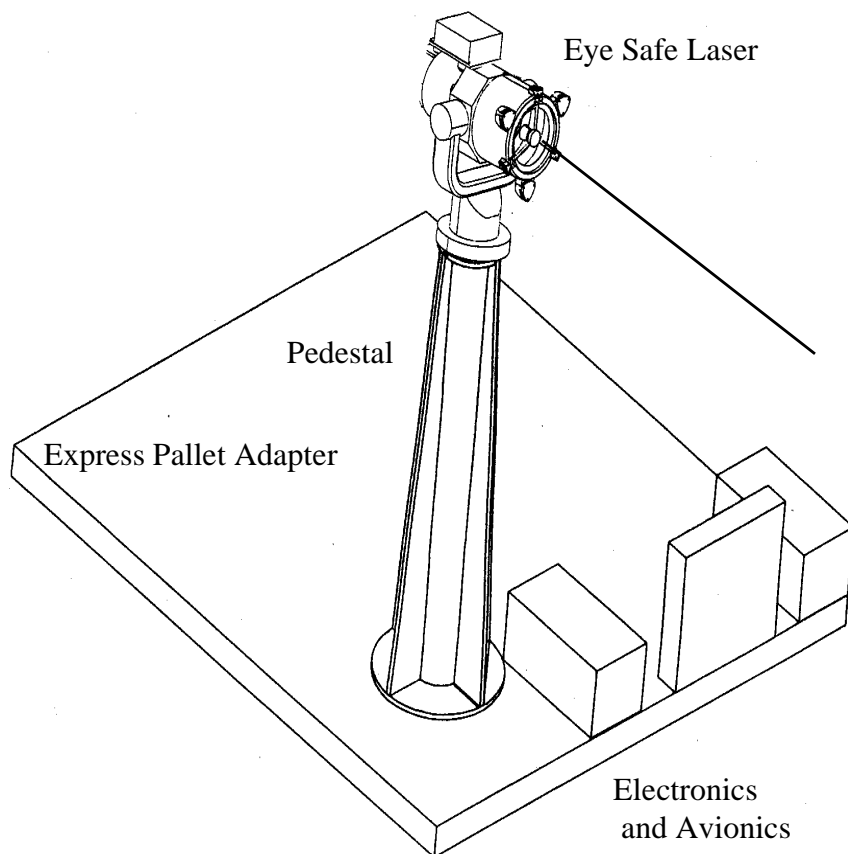
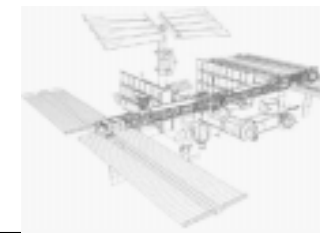
Instrument Construction

- Two flywheels in opposite rotation
- Magnetic bearings
- 60,000 RPM

Cost sharing Cooperative Agreement



Optical Communications Demo (OCD)



Mission Objectives

- Establish and characterize a 1Gbps link
- Downlink ISS science data as service

Instrumentation

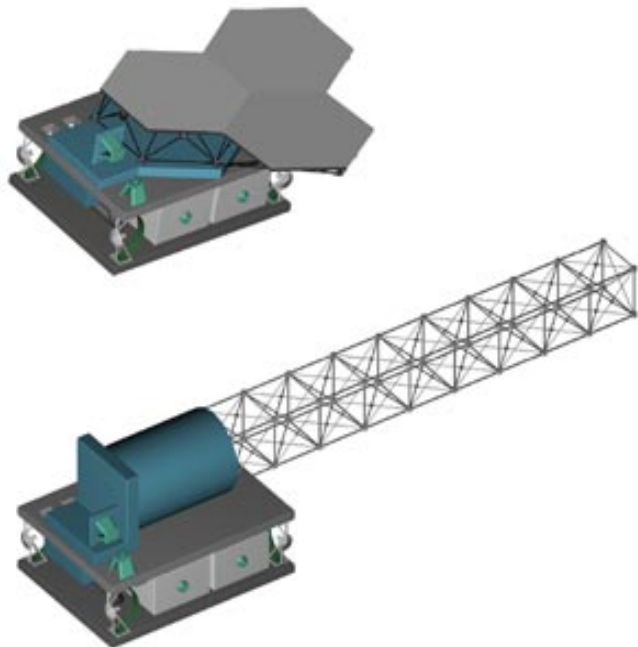
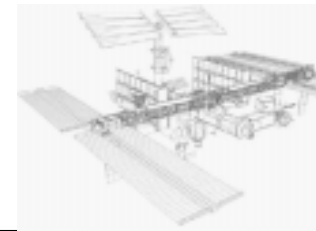
- On-orbit laser
- Ground station

Scheduled for Flight UF-3

Sponsored by ER&T



Micron Accuracy Deployment Experiment (MADE)



Scheduled for Flight UF-4 (TBC)

Sponsored by ER&T

Mission Objectives

- Re-useable flight laboratory
- Microdynamic measurements
- Deployment precision
- Active control test/performance

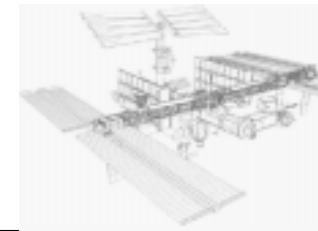
Instrumentation

- Sensors
- Test articles as supplied
 - Telescope mirrors
 - Interferometer booms

Facility with various contributing customers



Photovoltaic Engineering Testbed (PET)



Mission Objectives

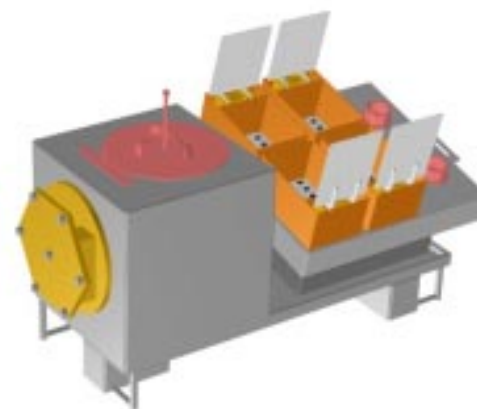
- Demonstrate a technical and cost effective way to calibrate, measure and qualify solar cells.

Instrumentation:

- Replaceable solar cell modules
- Beta angle solar tracking platform
- Environment monitoring devices

Facility with various contributing customers

**EXPRESS
Pallet Version**



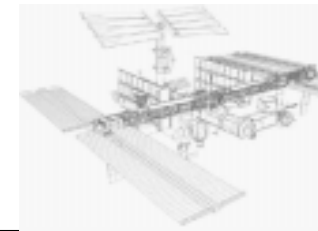
**JEM-EF
Version**

Scheduled for Flight UF-4 (TBC)

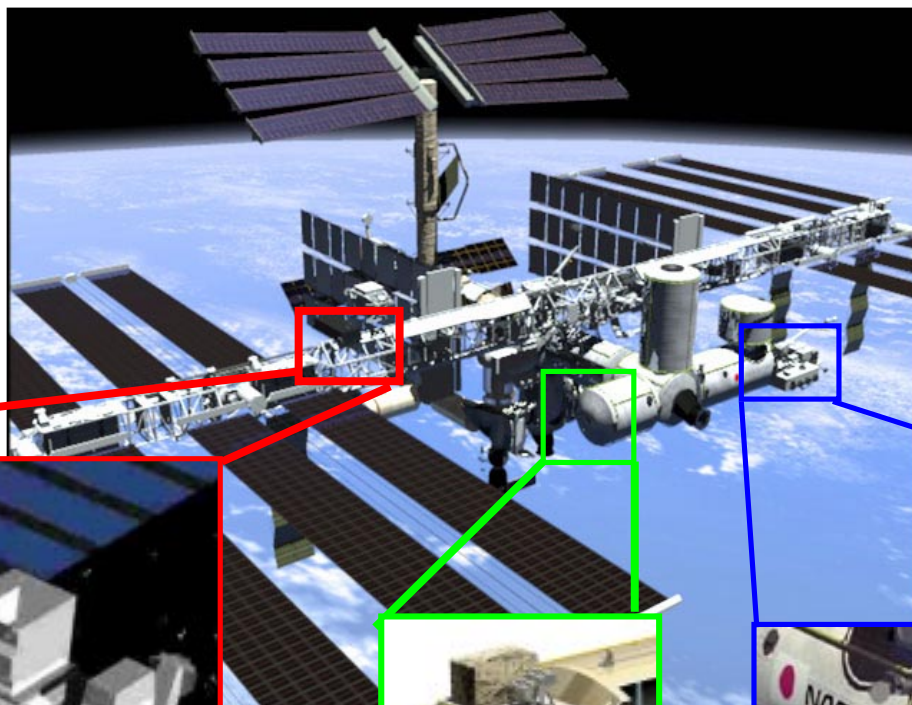
Sponsored by ER&T



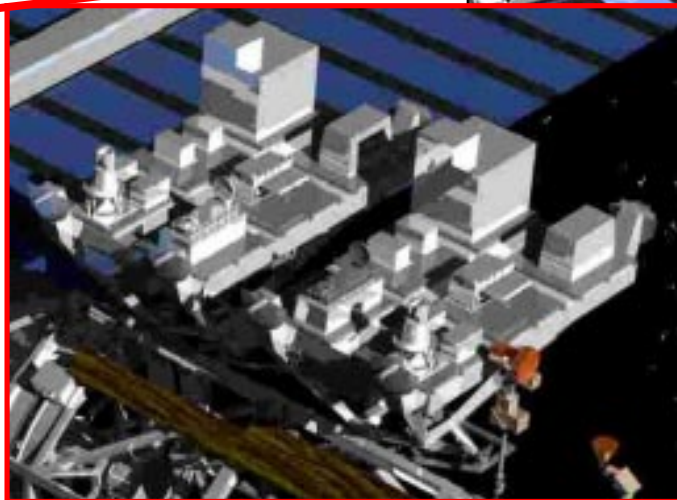
Standard External Payload Locations



S3 Truss
Sites



JEM
Exposed
Facility

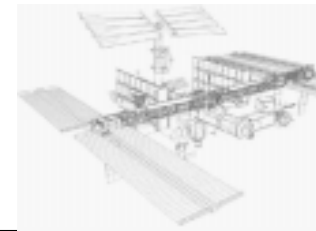


Columbus Exposed
Payload Facility





Low Temperature Microgravity Physics Facility (LTMPF)



Mission Objectives

- Facility for low-temperature microgravity
- Re-useable

Instrumentation

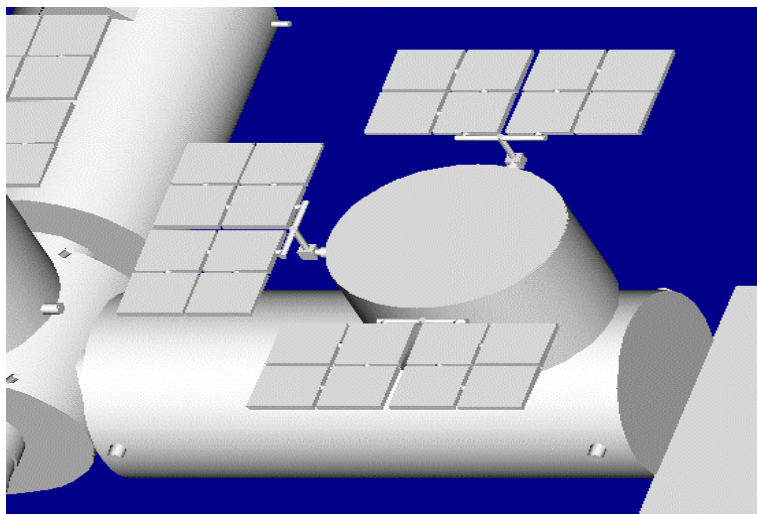
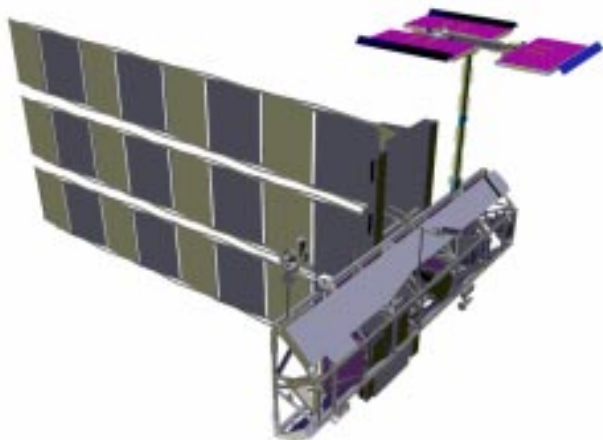
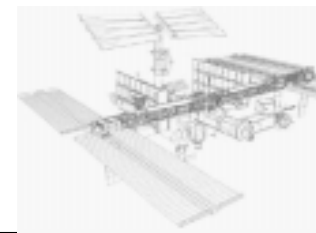
- Two flight units
- Vibration isolated
- Instrument temperatures between 0 and 4K
- Cryogen for greater than 5 months

Scheduled for Flight HTV2

Located at JEM-EF EFU #2



Extremely-heavy Cosmic-ray Composition Observer (ECCO)



Non-Standard Payload Location

On Utilization Plan / Not manifested

Mission Objectives

- Elemental composition of the ultra-heavy ($Z > 30$) galactic cosmic rays
- Origin of galactic cosmic rays

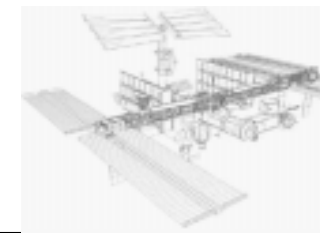
Instrument

- Track-etch detector
- 30 m² of barium-phosphate glass
- Can be subdivided (1.2 m² units)

3 Institutions are collaborating



Commercial Space Center for Engineering (CSCE)



Commercial Space Technology

Advanced Solar Power



Thermal Management



Remote Sensing



Radio Frequency Technologies

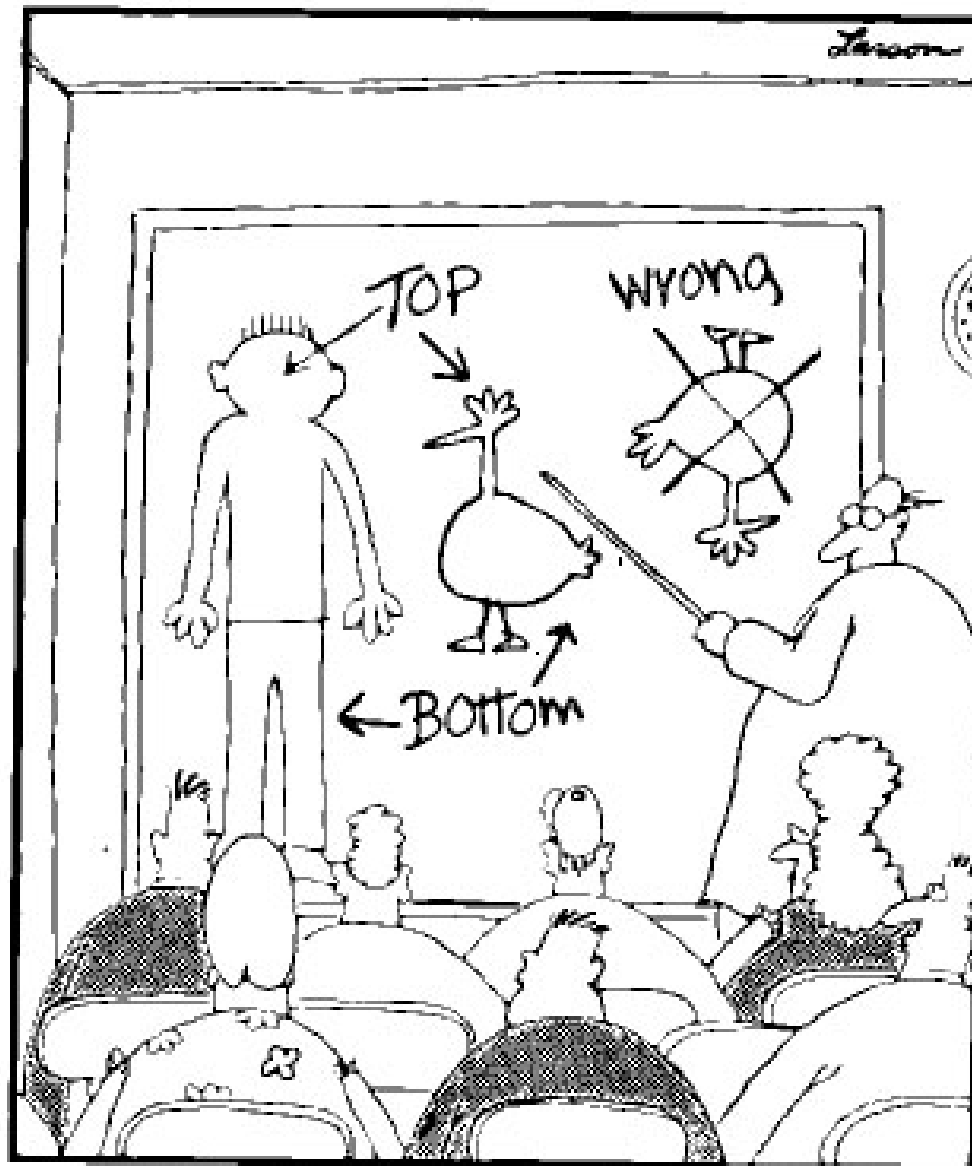


Technology
Validated for
Commercial Use

Commercial Markets



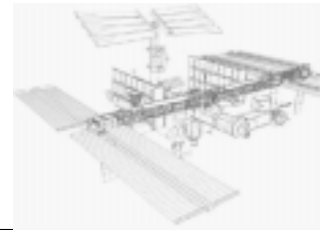
*Advancing Spacecraft Technology for
Commercial Applications
Using a Unique National Resource*



People who don't know which end is up

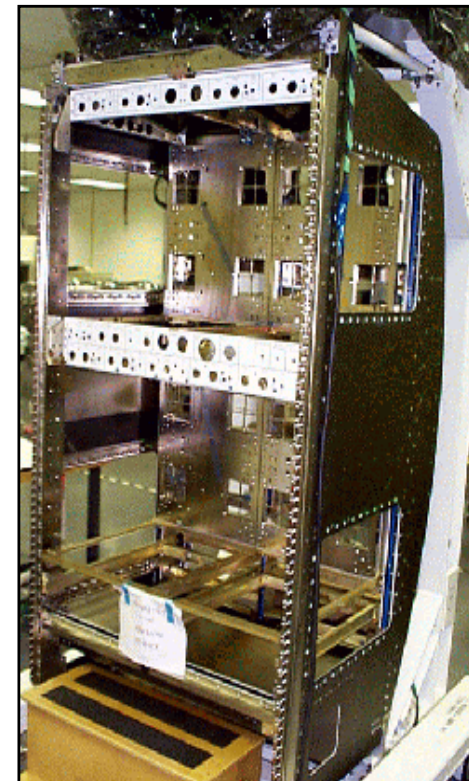


EXpedite the Processing of Experiments to the Space Station (EXPRESS**)**



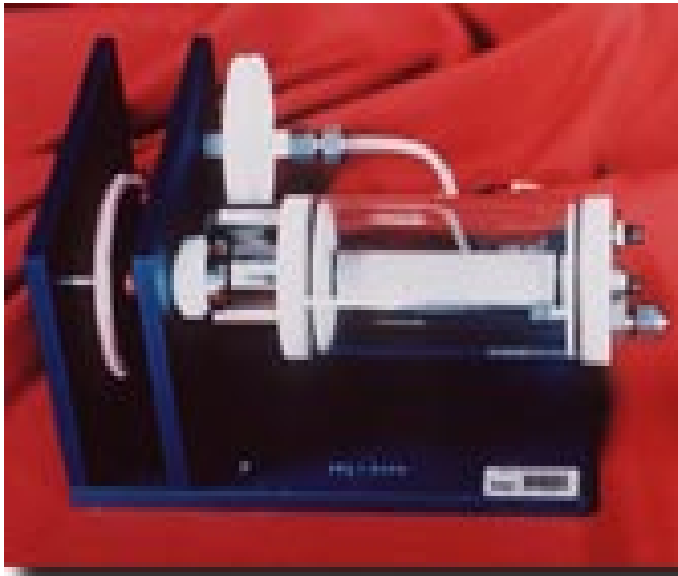
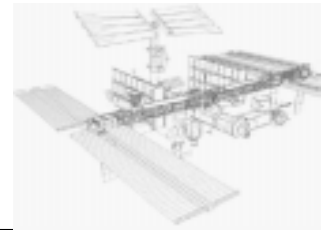
Purpose

- *Support small payloads on orbit*
- *Shortened ground integration period*
- *Standard interfaces, resources for subrack payloads*
- *Supports the simultaneous and independent operation of multiple payloads within the rack*
- *Launched with initial payload complement*

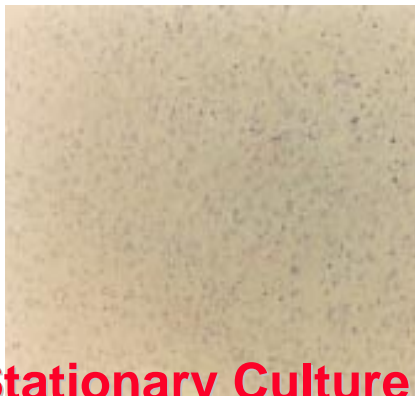




Tissue Culture ***..an experiment in 3-D***



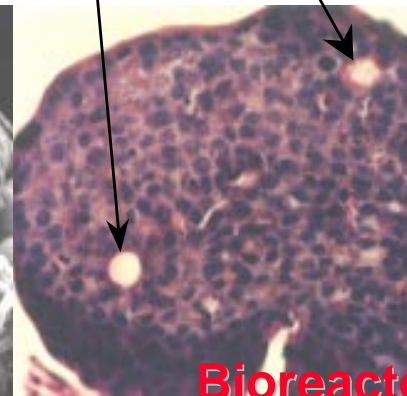
3-D colon cancer tumors grown in the Bioreactor resemble tumors extracted from humans, including polyps and gland-like structures



Stationary Culture



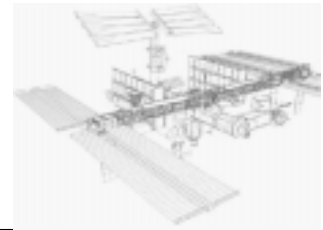
Bioreactor



Bioreactor



Commercial Product Development



Earth



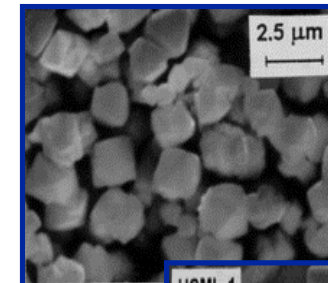
Aerogel

- transportation
- windows
- walls



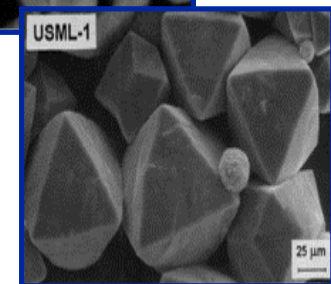
Space

Protein crystals
→ Drug design



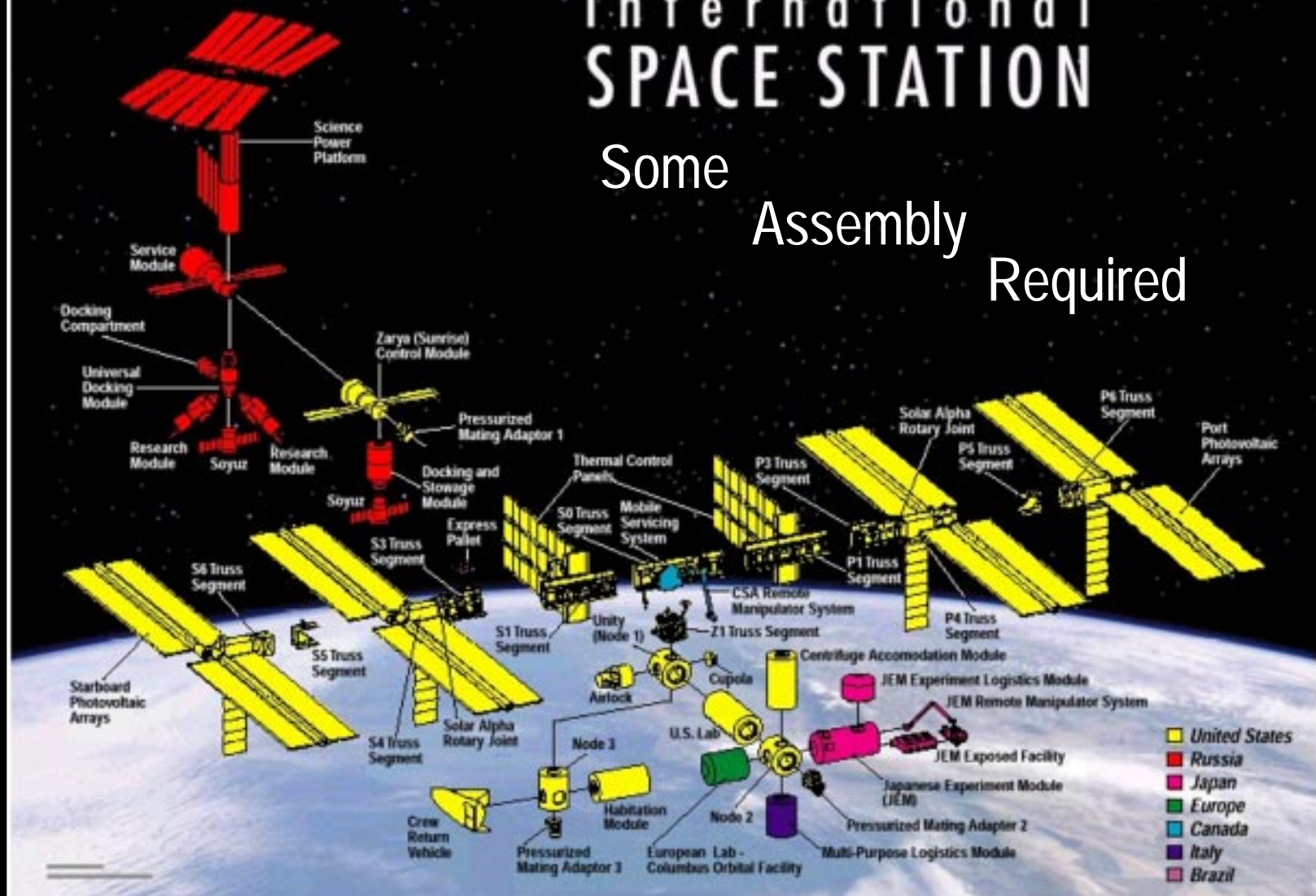
Zeolites

- oil refining
- detergents



International SPACE STATION

Some Assembly Required



*"The only limit to our realization of tomorrow will be our doubts of today.
Let us move forward with strong and active faith." FDR, 1945*



A photograph of a rocket launch at night. A large, bright full moon is in the upper left. A rocket is being launched, with a large plume of fire and smoke at its base. The rocket is white with a black nose cone. The launch pad is visible, with various structures and lights. The text "Yesterday's Dream is Today's Hope and Tomorrow's Reality" is overlaid on the image in a white, serif font. Below the main text, "R.H. Goddard 1926" is written in a smaller, similar font.

*Yesterday's Dream is
Today's Hope and
Tomorrow's Reality*

R.H. Goddard 1926